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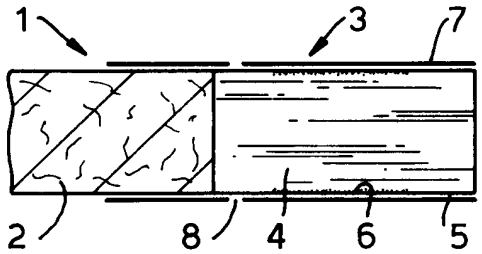
(54) Improvements relating to smoking articles.

(57) The present invention provides a solution to reduce the lingering smell in confined spaces associated with smoked filter tipped cigarette butts. Unlike other methods the invention does not require any active step by the smoker to activate any deodorising material. The present invention provides a smoking article incorporating a tobacco smoke filter element which exhibits in a passive manner a deodorising property even after smoking has occurred. The filter element incorporates a vapour phase absorbing material which is maintained substantially free from contact by the particulate phase of tobacco smoke, yet which is open to diffusion contact with the vapour phase of tobacco smoke both during and after smoking of the smoking article.

Fig.1.



EP 0 664 964 A2

The present invention relates to smoking articles comprising filter elements having means to reduce vapour phase constituents of tobacco smoke therein.

After smoking of a smoking article, such as a filter-tipped cigarette, has occurred the remaining butt or unsmoked remnant of the smoking article often exhibits a strong smell which becomes quite a stale smoke smell, especially over extended periods of time. It is presently desirable to provide some means of removing or significantly reducing the stale smoke smell which emanates from the particulate matter deposited in the butt end of a smoking article.

Our co-pending UK Patent Application Nos. 9320138.2, 9320139.0 and 9320130.9 all filed on 30 September 1993 describe various methods of deodorising a tobacco smoke filter element. These methods all require the smoker to break a capsule containing deodorising material, the capsule being held within the tobacco smoke filter element, when the smoker stubs out his butt or unsmoked remnant of the smoking article. A disadvantage of these methods is that our research has now shown that a minority of smokers do not actively stub out their butts in a manner which results in the deodorising capsule breaking and releasing the deodorising material.

The present invention seeks to overcome the need for an active part to be played by the smoker once smoking of a smoking article has ceased. It is an object of the present invention to provide a smoking article incorporating a tobacco smoke filter element which, even after smoking has occurred, still exhibits, in a passive manner, a deodorising property.

As used herein the term 'passive' or 'passive manner' means that no actual part is required of the smoker in order for the remnant of the smoking article or butt to exhibit a deodorising property.

The present invention provides a smoking article comprising a tobacco smoke filter element and a wrapped rod of tobacco filler material interconnected by a tipping wrapper, the filter element comprising absorbing material for absorbing the vapour phase constituents of smoke, a tobacco smoke flow path, the tobacco smoke being substantially confined to the tobacco smoke flow path, the absorbing material removing the vapour phase constituents from the tobacco smoke by diffusion of the vapour phase constituents from the tobacco smoke into the absorbing material, and the absorbing material exhibiting the further technical effect of being capable, even after smoking has finished, of absorbing vapour phases emanating from odorous compounds found within the smoked filter element.

The use of carbon or activated carbon in tobacco smoke filter elements to reduce vapour phase constituents of smoke has been known for some while. Our co-pending European Patent Application No. 93305082.5 teaches a tobacco smoke filter element having a carbon section, which carbon section is not contacted by the particulate smoke phase. Ventilation means is utilised at a specific location to channel the tobacco smoke away from the filter so that the carbon section does not become contaminated by the tobacco smoke.

We have now discovered that the arrangement described in the aforesaid pending European application also exhibits an excellent deodorising property and is one embodiment of the present invention.

Advantageously the vapour phase absorbing material is located annularly about the tobacco smoke flow path. Preferably the absorbing material is held on material, such as plugwrap, enwrapping the tobacco smoke flow path. Even more preferably, the absorbing material is located in longitudinally spaced arrangement along the length of the plugwrap. This arrangement enables cutting of the unitary filter element to provide in an integral member a double or triple filter-type arrangement without the requirement to cut through material loaded with abrasive granules of absorbing material, for example, carbon, activated carbon or other well-known vapour phase absorbing materials.

The vapour phase absorbing material for use in the present invention may advantageously be carbon or activated carbon, suitably in granular form. Other suitable absorbing materials, such as silica, zeolites, Attapulgite clay, high surface area chalk, magnesium hydroxide, for example, or synthetic high surface area absorbing materials will be known and obvious to the skilled reader.

Preferably the tobacco smoke flow path comprises fibrous filtration material, such as cellulose acetate. Preferably the tobacco smoke is confined to the tobacco smoke flow path by channelling the smoke away from the vapour phase absorbing material. More preferably channelling is produced by ventilating into the upstream end of the filter element. Preferably the upstream end of the filter element comprises material not coated with absorbing material. Ventilation into that part of the material causes no tobacco smoke at all to contact the absorbing material. The material, at least in this area, may suitably be permeable, although where ventilation in to the filter element is achieved by perforating both the tipping wrapper and the material, this is not essential.

In an alternative embodiment, the vapour phase absorbing material is located in a recess or recesses in filtration material which provides a tobacco smoke flow path. The recess or recesses may advantageously be a groove or grooves extending longitudinally or annularly on the surface of the filter element. The vapour

phase absorbing material may be attached to plugwrap material at spaced locations which register with the recess or recesses in the surface of the filtration material providing a tobacco smoke flow path.

Alternatively, the recess or recesses may be located axially disposed within the filter element as a core, which core may be shaped on the surface thereof. Filtration material suitably surrounds the core. In both of the above embodiments, the recess or recesses may suitably be physically separated from the filtration material by a wrapper, which may be vapour phase permeable.

In a related but alternative embodiment the tobacco smoke filter element comprises a central core of vapour phase absorbing material, about which is arranged an annulus of tobacco smoke filtration material, such as cellulose acetate. Other suitable filtration materials include fibrous polypropylene or polyethylene tow.

The core of absorbing material is advantageously wrapped with a vapour phase permeable wrapper to allow diffusion of vapour phase constituents into the core but to protect the absorbing material from contact with the particulate phase of the tobacco smoke. A barrier disc may be coaxially arranged at the tobacco end of the core to ensure that no smoke passes along the core.

The converse of this arrangement is also a suitable embodiment of the present invention, i.e. a sheath of absorbing material is located around a central core of filtration material. The core of filtration material may advantageously be wrapped with a vapour phase permeable wrapper.

In a similar but again alternative embodiment, the vapour phase absorbing material may be enclosed in an encapsulating material to form a capsule containing vapour phase absorbing material. The capsule is suitably elongate and extends coaxially lengthwise within the filter element. The ends of the capsule are impermeable to tobacco smoke flow, particularly the particulate matter of tobacco smoke but not necessarily the vapour phase constituents of tobacco smoke. The walls of the capsule along their lengthwise extent are advantageously perforated to enable vapour phase constituents of smoke to diffuse into the capsule and contact the core of absorbing material.

Preferably the pressure drop of the filtration material tobacco smoke flow path is less than the pressure drop of the capsule of absorbing material. Ventilation may be used to assist in this goal.

In yet a further alternative, the vapour phase absorbing material may be present in the plugwrap of the filter element. The absorbing material is, therefore, incorporated in the furnish of the plugwrap as the plugwrap is manufactured. Preferably the absorbing material, if it absorbs water from the paper making stage, releases the water on drying of the paper.

Diffusion of the vapour phase constituents of tobacco smoke into the absorbing material occurs in all embodiments of the invention.

In order that the invention may be easily understood and readily carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which;

Figure 1 shows part of a smoking article according to the present invention,

Figure 2 shows a cross-section of a filter element incorporated in a smoking article according to a further embodiment of the present invention,

Figure 3 shows part of a smoking article according to another aspect of the present invention,

Figure 4 shows part of a smoking article according to an alternative embodiment of the present invention; and

Figure 5 shows part of a smoking article which is yet another embodiment of the present invention.

In Figure 1 there is depicted part of a cigarette 1 comprising a wrapped rod 2 of tobacco filler material, such as cut tobacco lamina and a proportion of stem. The tobacco filler material may comprise a proportion of expanded tobacco. The filter element 3 comprises a body 4 of fibrous cellulose acetate filtration material. The filtration material could also be polypropylene or polyethylene fibrous material, paper, or polyethylene film material, which may be a separate unit. The body 4 of fibrous filtration material is wrapped in a plugwrap 5. The body 4 of filtration material provides a tobacco smoke flow path. A central portion 6 of the plugwrap 5 is coated on the inner side thereof with a layer of adhesive and a vapour phase absorbing material, in this instance granular carbon material. At the upstream side of the absorbing material, the overwrapping tipping material 7 is provided with perforations 8 which are either located in the tipping or extend through the tipping and the plugwrap into the body 4 of filtration material. The perforations 8 serve to channel the tobacco smoke into the centre of the body 4 of filtration material. In this way the tobacco smoke is substantially all confined to the tobacco smoke flow path within the body 4 of filtration material and does not come into contact with the vapour phase absorbing material.

In operation, the filter element 3 serves to filter particulate matter from the tobacco smoke of a lit wrapped rod 2, whilst vapour phase constituents diffuse outwardly during smoking of the cigarette 1 and are absorbed by the absorbing material 6. Because the tobacco smoke is constrained towards the centre of the body 4 of filtration material, the absorbing material is not contaminated with all of the components of

tobacco smoke and is therefore very effective at reducing the vapour phase constituents of smoke.

Furthermore, owing to the lack of contamination and, hence, enhanced effectiveness of the absorbing material, the absorbing material is also able to absorb the vapour compounds emanating from odorous material in the particulate matter within the smoked remnant, or butt, of the cigarette 1. This reduces the undesirable stale smoke odour present in cigarette butts after smoking has ceased. The filter element thus serves a dual absorbing purpose, absorbing compounds both during and after smoking.

Subjective tests of cigarettes according to this invention with carbon loading levels of about 25mg per cigarette which have been smoked and the butts left in a sealed container show that, compared to control cigarettes with conventional cellulose acetate filter elements, cigarettes according to the present invention exhibit a significant reduction in stale smoke odour.

The level of decrease in smoke odour compounds can be measured against a control smoked cigarette butt using, for example, an DL-101 Photo Ionisation Analyser made by HNU Systems Inc. The results of smoking cigarettes according to the invention against control cigarettes are given in Table 1 below. In the experiment, the control cigarette comprised a conventional filter element of fibrous cellulose acetate, 37mm in length, and a 58mm long tobacco rod comprising cut Virginia tobacco wrapped in a paper wrapper having a permeability of 50 CU and treated with 1% potassium citrate. The control cigarette is what might be termed a conventional cigarette.

The cigarettes smoked against the control cigarette were of the same format as the control cigarette. Smoking was carried out to a butt length of 36mm under standard machine smoking conditions according to which a 35cm^3 puff of two seconds duration is taken every minute. Two comparative cigarettes containing carbon were used. The first cigarette comprised a conventional dual carbon filter element having two adjacent separate lengths one length of 17mm, comprising fibrous cellulose acetate and the other length of 9mm, comprising carbon granules distributed throughout fibrous cellulose acetate. The second cigarette was a cigarette according to the present invention and comprised an integral cellulose acetate filter element 26mm long wrapped in a plugwrap comprising a central portion having carbon granules adhered to the inner face thereof in accordance with Figure 1 hereof. This type of filter element is known as an Active Patch Filter (RTM).

Two cigarettes of each type of cigarette were smoked and the butts of each pair of smoked cigarettes placed in sealed plastic containers. The lid of the container is removed and the probe of Photo Ionisation Analyser was quickly inserted a fixed amount into each container for a fixed time of 5-10 seconds. The maximum instantaneous reading from the detector is recorded in Table 1.

TABLE 1

	Maximum instantaneous photoionisation detector reading (ppm equivalent of benzene)		
Sample	**1 Hr. after smoking**	**20 Hrs. after smoking**	**Subjective ranking after 20 Hrs.***
Control (cellulose acetate filter)	36.3	31.4	1
Dual carbon/CA filter	43.5	36.7	2
Active patch filter	43.1	29.7	3
Active patch 18% ventilation	31.1	17.1	4 =
Dual carbon/CA 40% ventilation	33.9	31.3	4 =
Active patch 40% ventilation	27.2	14.6	6

* The subjective ranking is such that the lowest ranking indicates the most intense odour.

It can be seen from Table 1 that the dual carbon filter and the unventilated active patch carbon filter exhibit better reduction in smoke odour after 1 hour. In contrast, ventilation of the active patch filter exhibits a marked reduction in smoke odour at 18% ventilation and an even more pronounced reduction at 40% ventilation. It can also be seen that the vapour phase odour compounds continue to be absorbed over the 20 hours after smoking.

Ventilation of the dual acetate filter appears to give some reduction in smoke odour after 1 hour but no continued absorption over 20 hours. Some dissipation of smoke odour occurs with all samples over 20 hours.

Table 1 also includes the subjective ranking assigned to the cigarette after 20 hours. The 40% ventilated active patch filter gives the best smoke odour reduction subjectively.

Suitably the loading level of carbon as the absorbing material is within the range of 15-100mg per cigarette filter element. Other absorbing materials may vary from the range but can readily be determined by experimentation and will, of course, depend on the absorbing capability and/or surface area of the selected absorbing material.

Figure 2 shows in cross-section the filter element of a second embodiment of the inventive concept. Filter element 10 comprises a tobacco smoke flow path 11 of fibrous cellulose acetate filtration material. Non-wrapped acetate may also be utilised. The filtration material has been, for example, thermally moulded to provide grooves 12 on the surface of the filter element 10. The filtration material may be provided with a vapour phase permeable wrapper 13 which physically separates the filtration material from vapour phase absorbing material 14 located within the grooves 12. The wrapper 13 is not an essential feature. The vapour phase absorbing material 14 is activated carbon in the form of granules. The carbon is adhered to plugwrap 15 which enwraps the filter element along the longitudinal extent thereof. Alternatively, the carbon may be adhered to the surface of the filtration material.

Tobacco smoke is constrained to flow substantially only through the filtration material. Vapour phase smoke constituents can diffuse outwardly into the carbon granules. This arrangement allows the vapour phase absorbing material 14 to further absorb vapour phases from the odorous material found in smoked cigarette filter elements.

The converse arrangement of absorbing material and filtration material is a further embodiment of the inventive concept.

Figure 3 depicts a cigarette 31 according to the present invention comprising a wrapped rod 32 of tobacco filler material interconnected by a tipping wrapper 37 to a filter element 33 comprising a body 34 of a fibrous filtration material, such as cellulose acetate, and an elongate capsule 35 containing vapour phase absorbing material such as granular carbon. The capsule 35 is enclosed in an encapsulating material which prevents the inflow of tobacco smoke therein at either end. Along the length of the walls of the capsule 35 are perforations 36 which enable vapour phase constituents to diffuse into contact with the absorbing material. The filter element is arranged so that the tobacco smoke is constrained to flow within the body 34 of filtration material and particulate matter from the smoke does not contaminate the absorbing material.

In this embodiment, the pressure drop of the capsule and the surrounding filtration material are arranged so that the tobacco smoke is constrained to flow along the tobacco smoke flow path, separate from the vapour phase absorbing material.

The embodiment of the invention depicted in Figure 4 shows a cigarette 101 having a wrapped rod 20 of tobacco filler material and a filter element 30 interattached by tipping wrapper 70. Filter element 30 comprises an annular body 40 of filtration material, such as fibrous cellulose acetate, wrapped in a plugwrap. As a core 19 within the body 40 there is located carbon as an absorbing material. The core 19 is provided with a wrapper 100 which is permeable to the vapour phases of tobacco smoke and thus prevent contamination of the absorbing material by particulate matter of tobacco smoke.

The filter element 30 is ideally arranged so that the pressure drop of the core 19 is greater than the pressure drop of the annular body 40, whereby the tobacco smoke is constrained to flow along the tobacco smoke flow path of body 40. Where the pressure drops of the various materials do not readily allow this to occur, a barrier 21 may be utilised, possibly in addition to wrapper 100, to prevent smoke flowing along the core 19.

The embodiments of Figures 3 and 4 may not rely solely on the pressure drop arrangement of the core of absorbing material and the body of filtration material in order to constrain the tobacco smoke substantially to the tobacco smoke flow path provided by the filtration material. The tobacco smoke may be confined to the tobacco smoke flow path because the particulate matter of the smoke is physically prevented from contacting the vapour phase absorbing material.

Figure 5 depicts a conventional filter element 300 of fibrous cellulose acetate filtration material interattached to a wrapped rod 200 of tobacco filler material by a tipping wrapper 700. A plugwrap 500 incorporated vapour phase absorbing material therewithin. Ventilation perforations may be provided if so desired. Tobacco smoke is confined to the flow path provided by the filtration material, whilst vapour phase smoke constituents can diffuse outwardly to the plugwrap.

In all of the above embodiments, after absorbing vapour phase constituents from the smoke the absorbing material is able to absorb the vapour phases emanating from odorous compounds found within a smoked cigarette butt, thus decreasing the stale smoke odour.

In subjective smoke tests of cigarettes according to the embodiments described with respect to Figures 3, 4 and 5 of the present invention with carbon loading levels of about 25mg smoked against control

cigarettes containing no carbon, the inventive cigarettes exhibited a noticeable reduction in stale tobacco smoke odour when sealed containers containing the inventive and control cigarette butts were opened and compared. The level of decrease in smoke odour compounds can be measured against a control smoked cigarette butt using a DL-101 Photo Ionisation Analyser made by HNU Systems Inc.

Suitably the loading level of carbon as the absorbing material is within the range of 15-100mg per cigarette filter element. Other absorbing material may vary from this range but can readily be determined by experimentation and will, of course, depend on the absorbing capability and/or surface area of the selected absorbing material.

Claims

1. A smoking article comprising a tobacco smoke filter element and a wrapped rod of tobacco filler material interconnected by a tipping wrapper, the filter element comprising absorbing material for absorbing vapour phase constituents of smoke, a tobacco smoke flow path, the tobacco smoke being substantially confined to said tobacco smoke flow path, said absorbing material removing vapour phase constituents from said tobacco smoke by diffusion of vapour phase constituents from said tobacco smoke into said absorbing material, and said absorbing material exhibiting the further technical effect of being capable, even after smoking has finished, of absorbing vapour phases emanating from odorous compounds found within the smoked filter element.

2. A smoking article according to Claim 1, wherein said vapour phase absorbing material is located annularly about said tobacco smoke path.

3. A smoking article according to Claim 2, wherein said absorbing material is adhered to plugwrap material at longitudinally spaced locations.

4. A smoking article according to Claim 1, 2 or 3, wherein said tobacco smoke flow path comprises fibrous filtration material.

5. A smoking article according to Claim 1, 2, 3 or 4, wherein the tobacco smoke is confined to said tobacco smoke flow path by channelling the smoke away from said vapour phase absorbing material.

6. A smoking article according to Claim 5, wherein the channelling of the smoke is produced by introducing ventilating air into the upstream end of said filter element.

7. A smoking article according to Claim 1, wherein the vapour phase absorbing material is located in one or more recesses in filtration material, which filtration material provides a tobacco smoke flow path.

8. A smoking article according to Claim 7, wherein the recess(es) is/are a groove or grooves extending longitudinally or annularly along the surface of said filter element.

9. A smoking article according to Claim 7, wherein the recess(es) is/are disposed within said filter element as a core, disposed about which is fibrous tobacco smoke filtration material.

10. A smoking article according to Claim 9, wherein said core of vapour phase absorbing material is wrapped with a vapour phase permeable wrapper.

11. A smoking article according to Claim 1, wherein said vapour phase absorbing material is comprised in a sheath located around a central core of tobacco smoke filtration material.

12. A smoking article according to Claim 9 or 11, wherein said vapour phase absorbing material is physically separated from said tobacco smoke filtration material.

13. A smoking article according to Claim 1, wherein said vapour phase absorbing material is enclosed in an encapsulating material which is impermeable to the particulate phase of tobacco smoke to form a capsule.

14. A smoking article according to Claim 13, wherein said capsule extends coaxially along the length of said filter element, the ends of the capsule being impermeable to the particulate phase of tobacco smoke.

15. A smoking article according to any one of the preceding claims, wherein the pressure drop of the filtration material tobacco smoke flow path is less than the pressure drop of the recess or capsule containing the vapour phase absorbing material.

16. A smoking article substantially as hereinabove described with references to Figures 1, 2, 3, 4 or 5 of the drawings hereof.

Fig.1.

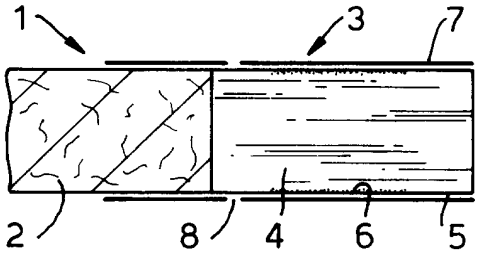


Fig.2.

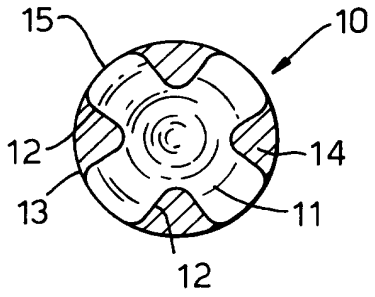


Fig.3.

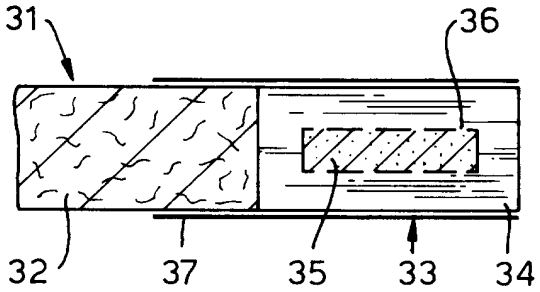


Fig.4.

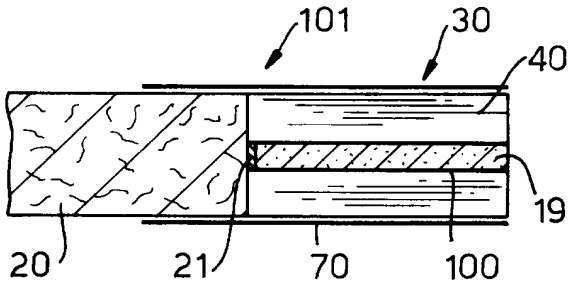


Fig.5.